4-23-2018

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Sarah Hayden

Belmont University

Project Faculty Advisors: Dr. Elizabeth Morse and Dr. Joseph Price

Faculty Team Member: Dr. Jamie Adam

Date of Submission: April 23, 2018

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Abstract

Purpose: The purpose of this scholarly project was twofold: 1) To identify the impact that health literacy, diabetes knowledge, self-efficacy, and illness perception have on diabetes self-management behaviors and 2) To assess differences in project variables between English and Spanish-speaking participants. The Individual and Family Self-Management Theory was used as a guiding theoretical framework. **Methods:** Thirty-three English-speaking and twenty-eight Spanish-speaking adults with Type 2 diabetes (n=61) were recruited from a diabetes private-practice in the Southeastern United States. Patients completed a cross-sectional composite survey composed of demographic information, the Brief Health Literacy Screener, Diabetes Knowledge Questionnaire (DKQ-24), Diabetes Management Self-Efficacy Scale (DMSES), Brief Illness Perception Questionnaire (B-IPQ), and the Summary of Diabetes Self-Care Activities (SDSCA). **Results:** Diabetes self-efficacy and illness perception were significant predictors of diabetes self-management behaviors. English-speaking participants possessed greater diabetes knowledge and perceived their illness to be more severe. English-speaking participants had greater health literacy, while Spanish-speaking participants had greater diet and foot care self-management behaviors. **Conclusions:** To improve self-management behaviors in adults with Type 2 diabetes, it is necessary to utilize patient-centered interventions, which focus on improving self-efficacy and illness perception, in an effort to improve self-management practices and therefore glycemic control. In addition, qualitative research, which assesses why linguistic differences exist in health literacy, illness perception, diabetes knowledge, and diabetes self-management behaviors would be valuable based on findings within this scholarly project.

Keywords: Type 2 Diabetes, Diabetes Self-Management, Health Literacy, Diabetes Knowledge, Diabetes Self-Efficacy, Illness Perception

Introduction and Background

In 2015, approximately 9.4% of the U.S. population had diabetes, with 90-95% of these cases being Type 2 (Centers for Disease Control and Prevention [CDC], 2017b). It is estimated that nearly 40% of the U.S. adult population will develop diabetes over the course of their lifetime, with the burden of disease being greater than 50% for Hispanic men and women (Gregg et al., 2014). This complex disease affects multiple organ systems, and places patients at greater risk of comorbid conditions and poor outcomes including heart disease, stroke, kidney failure, blindness, and amputations (CDC, 2017a). Not only is diabetes costly to the patient, but there is a burden of cost to the healthcare system as well.

Healthcare costs for individuals with diabetes are greater than twice that of those who do not have diabetes (CDC, 2017a). In fact, more than 20% of all healthcare dollars spent in the U.S. are on care for men and women with this disease (American Diabetes Association [ADA], 2013). In 2012, diabetes cost $245 billion, with $176 billion in direct costs such as medical care or prescription drug or supply expenses and $69 billion in indirect costs related to lost productivity, disability, and early death (ADA, 2013).

Diabetes can be managed through nutrition therapy, physical activity, smoking cessation, and pharmacologic intervention (Cefalu, 2016). However, rates of adherence to prescribed diabetes care plans remain low (Peyrot et al., 2005), and nearly half of the U.S. adult diabetic population is not meeting the recommended HgA1C target goal set out by the ADA (Ali et al., 2013). The typical primary care or specialist office visit is only around 20 minutes (Shaw, Davis, Fleischer, & Feldman, 2014). Because diabetes is a largely self-managed disease, a significant amount of patient involvement is required outside of a short office visit (Powers et al., 2015).

Problem Statement

Type 2 diabetes is a public health concern that must be addressed, as the burden of disease is not only high for individuals, but for society as well. It is evident that current methods of diabetes education and management are not permeating self-management behaviors necessary for glycemic control. Therefore, the project leader will conduct a cross-sectional assessment of diabetes knowledge, self-efficacy, health literacy, and illness perception in a language-diverse population with Type 2 diabetes; in order to determine how providers can best inform or encourage improved self-management behaviors in the short amount of time they are able to spend with patients.

Purpose

The purpose of this scholarly project is twofold: 1) To identify the impact that health literacy, diabetes knowledge, self-efficacy, and illness perception have on diabetes self-management behaviors and 2) To assess whether there are group differences in project variables between English and Spanish-speaking participants.

Review of Evidence

Type 2 diabetes is a chronic condition, which requires patients to make several daily self-management decisions and carry out complex self-care tasks (Powers et al., 2015). Self-management behaviors such as healthy eating, physical activity, blood glucose monitoring, medication adherence, risk reduction, problem solving, and healthy coping are essential for improving glycemic control, reducing long-term complications of the disease process, and improving quality of life (American Association of Diabetes Educators [AADE], 2017; Shrivastava, Shrivastava, & Ramasamy, 2013). However, engaging in the process of self-management takes time. Patients with diabetes spend an average of 58 minutes each day on self-care tasks (Safford, Russell, Suh, Roman, & Pogach, 2005). Because diabetes is largely managed outside of short, quarterly office visits, there must be a focus on improving patient self-management behaviors through education and support (Haas et al., 2014; Powers et al., 2015), as research has shown that self-management practices predict 95-98% of the variance in glycemic control (O'Connor et al., 2008; Tuerk, Mueller, & Egede, 2008).

In order for patients to exercise self-management behaviors, they must be able to apply disease-specific knowledge and utilize appropriate decision-making, which requires adequate health literacy (Fransen, von Wagner, & Essink-Bot, 2012). Health literacy is defined as "the degree to which an individual has the capacity to obtain, communicate, process, and understand basic health information and services to make appropriate health decisions" (CDC, 2016 [as cited in Patient Protection and Affordable Care Act, 2010]). Health literacy may be linked with self-management behaviors. However, this relationship is unclear within the literature. A systematic review conducted on the association between health literacy and diabetes self-management noted that only three of eleven studies found a direct positive relationship between health literacy and self-management behaviors, with eight studies showing no direct significant relationship (Fransen et al., 2012). This point is supported by Bains & Egede (2011), as well as Hahn et al. (2015), who noted that health literacy was not directly associated with self-management behaviors. Health literacy alone may not be enough to influence the daily self-management behaviors needed to control diabetes over the course of a lifetime (Cavanaugh, 2011).

However, diabetes knowledge may be a mediating variable, which helps to explain the relationship between health literacy and diabetes self-management behaviors (Bains & Egede, 2011; van der Heide et al., 2014). Conversely, other studies have noted that diabetes knowledge has more of a predicting than mediating role in foretelling self-management behaviors (Kueh, Morris, Borkoles, & Shee, 2015; Kugbey, Asante, & Adulai, 2017; McCleary-Jones, 2011).

In addition to health literacy and diabetes knowledge, self-management behaviors may be influenced by beliefs, attitudes, skills, motivation, and social support (Al-Khawaldeh, Al-Hassan, & Froehlicher, 2012). Self-efficacy, the belief or confidence that one has in their ability to effectively manage their disease process (Bandura, 1977), has been positively associated with self-management (McCleary-Jones, 2011; Al-Khawaldeh et al., 2012). For example, if a patient plans to exercise five times per week, but fails to do so because of competing priorities, they may experience a sense of failure and not feel capable to try again (Bodenheimer, Lorig, Holman, & Grumbach, 2002). Comparatively, if a patient with diabetes experiences success in adhering to their medication regimen, and begins to feel better with more stable blood sugars, they may sustain this self-management behavior over time, thereby improving glycemic control (Kwasnicka, Dombrowski, White, & Sniehotta, 2016). In addition, it is crucial to note that self-efficacy is culturally influenced (Oettingen, 1995), and Type 2 diabetes is a generational and heritable disease that disproportionately impacts certain populations, particularly Hispanics (American Diabetes Association, 2017; Gregg et al., 2014). If an individual attempts to manage their disease within a family or community context where health behaviors are not conducive to tight self-management, self-efficacy may be even more difficult to develop or maintain (Rosland, Heisler, Choi, Silveira, & Piette, 2010).

Finally, illness perception may play a role in determining diabetes self-management behaviors (Broadbent, Donkin, & Stroh, 2011). Illness perception is a patient’s cognitive and emotional view of their disease (Broadbent, Petrie, Main, & Weinman, 2006a). Previous studies have shown that as patients perceive their illness to be more severe, they are less likely to invest in diabetes self-management management behaviors (Abubakari, Cousins, Thomas, Sharma, & Naderali, 2011; Kugbey et al., 2017). Engaging in self-management behaviors involves complex decision-making, which often depends on patients' views of whether their disease process is controllable, understandable, curable, or severe (Kugbey et al., 2017). Therefore, it is crucial that providers elicit and work to understand patients' illness perception, in an effort to improve self-management behaviors.

Although health literacy, diabetes knowledge, self-efficacy and illness perception have been examined separately in terms of their relationship with diabetes self-management, it is crucial to recognize that these variables have more of a multifactorial than a linear relationship. For example, McCleary-Jones (2011) noted that those with improved health literacy had greater diabetes knowledge, and improved diabetes knowledge was positively associated with dietary self-management behaviors. Likewise, Osborn, Cavanaugh, Wallston, & Rothman (2010) noted that those with improved health literacy and numeracy had greater levels of self-efficacy, and self-efficacy was associated with improved glycemic control. Thus, it is crucial that health literacy, diabetes knowledge, self-efficacy, illness perception, and self-management behaviors are studied in tandem.

Previous literature has shown that Hispanics have lower health literacy (U.S. Department of Health & Human Services: Office of Disease Prevention and Health Promotion, 2008), less diabetes knowledge (Centers for Medicare & Medicaid Services: Office of Minority Health, 2017), and less diabetes self-efficacy than their White counterparts (Sarkar, Fisher, & Schillinger, 2006). To this author's knowledge, no current literature exists on Hispanics' Type 2 diabetes illness perception. Therefore, this study will add to the body of research in this area. Although each of these variables has been studied independently or in smaller combination with one another, health literacy, diabetes knowledge, self-efficacy, and illness perception have not yet been studied together to determine how these variables may impact self-management behaviors in English and Spanish-speaking patients with Type 2 diabetes.

Theoretical Framework

The Individual and Family Self-Management Theory was used to guide this scholarly project. This descriptive mid-range theory was published in 2009 by Polly Ryan and Kathleen Sawin. Dr. Ryan, a Registered Nurse who holds both a PhD and Clinical Nursing Specialist degree, had done previous work with the Integrated Theory of Health Behavior Change (Ryan & Sawin, 2009). Dr. Sawin, a Pediatric Nurse Practitioner, Doctor of Nursing Scientist, and Fellow of the American Academy of Nursing, had done previous work with the Ecological Model of Secondary Conditions and Adaptation (Ryan & Sawin, 2009). When funding became available and the Self-Management Science Center at University of Wisconsin-Milwaukee was founded, Dr. Ryan and Dr. Sawin combined their previous research and expertise to create the Individual and Family Self-Management Theory (Ryan & Sawin, 2009).

This theory was selected for use in this scholarly project, as it is a comprehensive framework for describing the context, process, and outcomes of disease self-management. This theory is not disease-specific. It has previously been tested in children with spina bifida and in adolescents with Type 1 diabetes (Verchota, 2014; Yun & Kim, 2017). However, its components have yet to be tested in a population of adults with Type 2 diabetes.

Ryan & Sawin (2009) posit that disease self-management is a complex and ever-changing phenomenon comprised of and influenced by three key dimensions: context, process, and outcomes. Context is composed of disease-specific factors, the social environment of care, and individual and family features, each of which directly influences how individuals and families engage in the process of self-management.

Process is composed of diabetes knowledge and beliefs, self-regulation abilities, and social facilitators. Ryan & Sawin (2009) theorize that when individuals and families take part in the process of self-management, they move towards the achievement of proximal and distal health outcomes. For example, if a patient is participating in the process of self-management, and therefore has a controlled hemoglobin A1C, it is likely that they will have reduced risk of morbidity and mortality associated with their diabetes. In addition, contextual factors directly impact both proximal and distal outcomes. Proximal outcomes include disease-specific self-management behaviors while distal outcomes relate to overall health status, quality of life, and healthcare costs. In sum, Ryan & Sawin (2009) theorize that context affects both process and outcomes, while process simply affects outcomes.

Ryan & Sawin (2009) have identified seven pertinent assumptions of the Individual and Family Self-Management Theory that relate to this scholarly project: 1) Individuals take part in health behaviors for reasons that are personally meaningful to them, which may or may not be linked to improved health outcomes. 2) There are multiple social and environmental factors that influence an individual's behavior. 3) Contextual factors affect the ability and need to engage in the process of self-management. 4) Perception of available resources affects whether an individual or family partakes in self-management behaviors. 5) Self-management is a continual process, which requires time, iteration, and reflection. 6) Social facilitation can enhance or incite implementation of self-management behaviors. 7) Individuals who are actively engaged in managing their condition with a healthcare provider may achieve their health goals.

The Individual and Family Self-Management Theory was used to examine how health literacy, diabetes knowledge, illness perception, and self-efficacy impacted self-management behaviors.

This scholarly project captured contextual data related to diabetes-specific factors, the physical and social environment of care, and individual features. For example, treatment complexity was assessed through query of whether patients use an insulin pump. Environment of care was assessed through a survey question, which determined how long the individual had been under the care of the primary provider at this diabetes-specific practice. Finally, individual features such as health literacy and information processing were captured by the Brief Health Literacy Screener.

The process construct was measured through assessment of participants' diabetes knowledge and beliefs, self-regulation abilities, and social facilitators. The Diabetes Management Self-Efficacy Scale and Diabetes Knowledge Questionnaire captured data on patients' knowledge and beliefs. The Brief Illness Perception Questionnaire measured patients' self-regulation skills and abilities. Social facilitation was assessed through query of whether patients utilized assistance with diabetes self-management behaviors or performed them independently. Diabetes self-management behaviors were measured by the Summary of Diabetes Self-Care Activities Questionnaire, which served as a proximal outcome measure. No distal outcomes were directly measured within this scholarly project.

Assertions

The project leader asserts that contextual and process factors will impact the outcome of diabetes self-management. In addition, the project leader asserts that there will be group differences in project variables between English and Spanish-speaking participants.

Project Design

This scholarly project utilized a cross-sectional survey design to measure health literacy, diabetes knowledge, self-efficacy, illness perception, and diabetes self-management behaviors in English- and Spanish-speaking patients with Type 2 diabetes. The Institutional Review Board (IRB) at Belmont University evaluated this protocol and verified it to be exempt from further review, as the survey was anonymous and completing the survey carried no risk to human subjects.

Clinical Setting

This scholarly project was conducted at a small diabetes-specific private practice in the southeastern United States. This practice is owned and operated by a doctorally-prepared nurse practitioner and her office manager, both of whom are native Spanish-speakers who are bilingual. This clinic provides specialty care to approximately 175 patients, half of whom are English-speaking and half of whom are Spanish-speaking (Personal communication, September 11, 2017). Patients are referred to this clinic due to disease severity and/or for language-concordant care. Roughly 90% of the patients seen at this clinic have Type 2 diabetes (Personal communication, September 11, 2017).

Project Population

The project leader began with a convenience sampling technique, which transitioned into purposive sampling in an effort to gain a representative sample of both English and Spanish-speaking patients, with a sample size goal of 30 English-speaking and 30-Spanish-speaking patients. Patients were eligible to participate if they: (1) possessed the ability to read and write in English or Spanish, (2) had a diagnosis of Type 2 diabetes, (3), were age 18 or older, and (4) were established patients at the clinic. Patients were excluded if they experienced any form of cognitive impairment, such as a history of dementia or other neurologic or psychologic condition, which profoundly affects cognition. Eligibility criteria were selected on the basis that (1) patients would complete the survey independently, and (2) surveys were only offered in English or Spanish. Since cognitive impairment may skew health literacy results (Nguyen et al. 2013), it was required that project participants were established at the clinic so the nurse practitioner could help to exclude patients with this feature.

Data Collection Process and Procedures

The project leader, a Registered Nurse, and the office manager at the clinic served as data collectors. Both individuals completed NIH Protection of Human Subjects training. Patients were recruited following their appointments at the clinic. Eligible patients were identified by the nurse practitioner and office manager prior to the beginning of each clinic day.

At the conclusion of an eligible patient's scheduled visit, the nurse practitioner briefly mentioned the project and opportunity for participation. Interested patients were invited to meet with the project leader or office manager in a private exam room to learn more about the project. Both data collectors used a script to describe the project. Patients were then handed an implied consent document with the survey tool attached. Patients who agreed to participate completed a paper-based survey in their primary language, either English or Spanish, which took approximately 15 minutes. Completed surveys were stored in a lock box and then transcribed into Microsoft Excel for further analysis.

Sources of Data

The cross-sectional survey used in this project included the collection of patient demographics, including: gender, ethnicity, primary language, age, marital status, level of education, years living with Type 2 diabetes, length of time in care at this diabetes-specific practice, and assessment of insulin pump usage. In addition, patients completed a composite tool, composed of the: (1) Brief Health Literacy Screener, (2) Diabetes Knowledge Questionnaire (DKQ-24), (3) Diabetes Management Self-Efficacy Scale (DMSES), (4) Summary of Diabetes Self-Care Activities (SDSCA), and (5) Brief Illness Perception Questionnaire (B-IPQ). All survey tools were available in English and Spanish versions.

Self-management.

Self-management behaviors were assessed using the Summary of Diabetes Self-Care Activities (SDSCA), an 11-item instrument, which assesses the frequency in which patients follow a healthy diet, exercise, self-monitor blood glucose, perform foot care, and take recommended diabetes medications (Toobert, Hampson, & Glasgow, 2000; Vincent, McEwen, & Pasvogel, 2008). The English version of this tool, written at a seventh-grade reading level (Vincent et al., 2008) is available in public domain (Toobert et al., 2000). Permission to use the Spanish version of this tool was obtained from Dr. Vincent.

Overall self-management scores were calculated. In addition, mean scores for each sub-scale on the tool were calculated, with item four reverse coded (Vincent et al., 2008). Higher scores overall and on the sub-scales suggested greater participation in self-care behaviors (Toobert et al., 2000). The highest possible overall self-management score was 77, with a range from 0-77. Highest possible scores for the diet, exercise, blood sugar, foot care, and medication adherence sub-scales were 35, 14, 14, 7, and 7, respectively. Ranges for the diet, exercise, blood sugar, foot care, and medication adherence sub-scales were 0-35, 0-14, 0-14, 0-7, and 0-7, respectively.

Toobert et al. (2000) reported on the results of seven studies, which utilized the SDSCA, and found significant correlations between dietary and exercise subscales and criterion variables.

This provides support for the validity of the instrument. In addition, in a study of 152 English-speaking patients with Type 2 diabetes, Cronbach's alpha was .72, demonstrating internal consistency of the SDSCA (Hunt, 2011). Moreover, the English version of the SDSCA has been found to have some significant correlations between sub-scales and patient traits, indicating that this tool may be generalizable in populations with differing insulin status, gender, and duration of diabetes diagnosis (Toobert et al., 2000).

The Spanish version of the tool, written at a sixth-grade reading level, is content valid and has conceptual equivalence with the English version of the tool (Vincent et al., 2008). Correlations for each item on the Spanish questionnaire ranged from .51 to .92, indicating test-retest reliability (Vincent et al., 2008). Vincent et al. (2008) added an additional question to their tool, which addressed whether the patient had smoked in the last seven days. With all 12-questions included, Cronbach's alpha was .68, demonstrating internal consistency (Vincent et al., 2008). However, the project leader did not include this question as part of this project's survey, as it was not part of the original English version of the SDSCA (Toobert et al., 2000) and the Spanish validation study found that this item had a low item-to-total correlation (Vincent et al., 2008).

Health literacy.

Health literacy was measured using the Brief Health Literacy Screener developed by Chew, Bradley, and Boyko (2004). This screener was slightly adapted to fit the project population. Permission to use the English version of the tool was granted from Dr. Chew. The Spanish version of the tool was available under the Creative Commons Attribution Noncommercial License within the validation article (Sarkar, Schillinger, López, & Sudore, 2011).

The Brief Health Literacy Screener was tested in a population of English- and Spanish-speaking adults with Type 2 diabetes, C-indices were .82 for confidence with forms, and .72 for difficulty understanding written information and .68 for assistance with reading health materials (Sarkar et al., 2011). The tool was able to differentiate between those with inadequate plus marginal health literacy in addition to identifying inadequate from adequate health literacy (Sarkar et al., 2011). This tool holds criterion validity, as it measured up well when tested against the s-TOFHLA, a gold-standard health literacy assessment tool (Sarkar et al., 2011). Responses to question one regarding confidence in filling out medical forms ranged from “not at all” to “extremely”, while responses for questions two and three regarding difficulty with written information or assistance with reading health materials ranged from “never” to “always” (Chew et al., 2004). Scoring was reversed for item one. Summative scores ranged from three to fifteen, with lower values indicating poorer self-reported health literacy (Sarkar et al., 2011).

Diabetes knowledge.

Patients’ diabetes knowledge was measured using the Diabetes Knowledge Questionnaire (DKQ-24), a 24-item instrument developed from recommendations made in the National Standards for Diabetes Patient Education Programs (Arora, Marzec, Gates, & Menchine, 2011; Garcia et al., 2001). This tool, written at a sixth-grade reading level (Arora et al., 2011), measured patients’ knowledge of diabetes medications, diet, exercise, glucose monitoring, foot care, and treatment modification (Garcia et al., 2001). This tool, in both English and Spanish, was procured from the original article (Garcia et al., 2001) and was available for use based on the ADA’s permission for reuse policy (ADA, n.d.).

Patients had the opportunity to respond in one of three ways to each question: yes, no, or don’t know. Patients received zero points for incorrect or don’t know responses, and one point for correct responses. Correct responses were then summed to determine a total score on the tool, with the highest possible score being 24. The DKQ-24 was originally tested in a group of Mexican Americans with Type 2 diabetes, and was administered to participants in Spanish, English, or a combination of both languages (Garcia et al., 2001). In this study, Cronbach's alpha was 0.78 and the tool was found to possess construct validity (Garcia et al., 2001).

Self-efficacy.

Self-efficacy was measured using the Diabetes Management Self-Efficacy Scale (DMSES), a 20-item tool developed for those with Type 2 diabetes (van der Bijl, van Poelgeest-Eeltink, & Shortridge-Baggett, 1999). This instrument was developed using knowledge from Bandura's social cognitive theory (van der Bijl et al., 1999). Bandura described self-efficacy as an individual's confidence in their ability to organize and carry out necessary actions in order to attain a desired outcome. (van der Bijl et al., 1999 [as cited in Bandura, 1986]). With this, van der Bijl et al. (1999) posit that self-efficacy cannot be measured as a general concept, as self-efficacy is situation or task-related. This knowledge guided the development of the DMSES, which queries patients' confidence to self-observe, self-regulate, and perform activities necessary for diabetes management (van der Bijl et al., 1999). The DMSES uses a 10-point Likert scale, with higher overall scores indicating greater diabetes self-efficacy (Hunt, 2011). The highest possible score on this tool is 200, with a range from 0-200. This tool was originally developed and tested in a group of Dutch individuals with Type 2 diabetes and was deemed to be content valid, with all items having a CVI score greater than 0.78 (van der Bijl, 1999). In this study population, test-retest reliability was 0.79 and Cronbach's alpha was 0.81, demonstrating internal consistency (van der Bijl, 1999).

The DMSES has since been translated and validated in a Spanish-speaking population of Hispanic older adults with Type 2 diabetes. In this study, inter-rater reliability was .88 and Cronbach's alpha was .87, establishing internal consistency (Coffman, 2008). Content equivalence was sought using cultural immersion and decentering techniques and semantic equivalence was sought using methods of back translation and expert review (Coffman, 2008). Permission to use the English version of the tool was obtained from Dr. van der Bijl and permission to use the Spanish version of the tool was obtained from Dr. Coffman.

Illness perception.

Illness perception was assessed using the Brief Illness Perception Questionnaire (B-IPQ), a nine-item instrument which assesses a patient's perception of diabetes causes, consequences, timeline, personal control, treatment control, identity, understanding, concern, and emotional response using a 0 to 10 Likert scale (Broadbent et al., 2006a; Broadbent, n.d.). Items three, four, and seven were reverse scored and added to items one, two, five, six, and eight (The Illness Perception Questionnaire, n.d.). A greater score indicated the patient had a more threatening view of their diabetes (The Illness Perception Questionnaire, n.d.). The highest possible score on this tool was 80, with a range from 0-80. This tool was originally tested in a group of patients with renal disease, Type 2 diabetes, asthma, minor illnesses, and chest pain (Broadbent et al., 2006a). Test-retest reliability was established in the sub-population of patients with renal disease. The B-IPQ holds concurrent validity when compared with the revised Illness Perception Questionnaire (Broadbent et al., 2006a). Finally, this tool possesses discriminative validity, as it was able to distinguish significant differences between beliefs in those different disease processes (Broadbent et al., 2006a).

The B-IPQ has been tested in a Spanish-speaking population and was found to have conceptual and linguistic equivalence with the English version (Pacheco-Huergo et al., 2010). The project leader reached out to the primary author for the tool used in this Spanish study. However, the project leader was unable to reach this individual and thus resorted to use of the translated version available on The Illness Perception Questionnaire website (Broadbent, Petrie, Main & Weinman, 2006b). Permission to use both the English and Spanish versions of the B-IPQ were obtained from one of the primary authors of the B-IPQ (E. Broadbent, personal communication, March 27, 2017).

Of note, in piloting the composite survey, the project leader sought input from two native Spanish speakers. Based on formative feedback, the composite tool was slightly adapted to reflect minor differences in local dialect, which only enhances the validity of the survey for use in this population.

Data Analysis

Data were entered into an Excel spreadsheet by the project leader and accuracy was ensured by random spot check of 10% of completed surveys. Data were analyzed using SPSS version 23.0, with statistical significance set at an alpha level of 0.05. Descriptive statistics were used to portray sample characteristics collected in the demographic questionnaire. Frequencies and percentages were reported for age, gender, ethnicity, survey version, marital status, education, length of Type 2 diabetes diagnosis, length of time in care at this diabetes-specific private practice, insulin pump usage, social support and health literacy questions. Means and standard deviations were reported for scores on the English and Spanish versions of the Brief Health Literacy Screener, DKQ-24, DMSES, B-IPQ and SDSCA. Independent t-tests were used to analyze differences between project variables in English and Spanish-speakers.

Power was assessed a priori using G*Power to determine a sample size of 128 was required to detect a medium effect size 0.50, $\alpha = 0.05$, power=0.80 with the independent t-test. Post hoc power analysis for Health Literacy $\alpha = 0.05$, n(33, 28) determined this test to have a power=0.48 to detect an effect size of 0.5. Post hoc power analysis for Diabetes Knowledge $\alpha = 0.05$, n(33, 26) determined this test to have a power =0.47 to detect an effect size of 0.5. Post hoc power analysis for self-efficacy $\alpha = 0.05$, n(33, 22) determined this test to have a power=0.41 to detect an effect size of 0.5. Post hoc power analysis for self-management, diet self-management, exercise self-management, blood sugar self-management, foot care self-management, and medication adherence self-management $\alpha = 0.05$, n(33, 24), determined this test to have a power= 0.45 to detect an effect size of 0.5 (Erdfelder, Faul, & Buchner, 1996). A stepwise linear regression was conducted to assess the effects of health literacy, diabetes knowledge, self-efficacy, and illness perception on self-management behaviors.

Results

Descriptive Statistics of Contextual, Process, & Outcome Factors

Context.

Table 1 presents contextual factors. Contextual factors included demographics, insulin pump usage, and health literacy level. The study sample was fairly evenly divided by primary language, with 54.1% (n=33) English-speaking and 45.9% (n=28) Spanish-speaking. More than half of participants were female (54.1%, n=33). In terms of ethnicity, 49.2% (n=30) of participants identified as Latino or Hispanic, 31.1% (n=19) identified as White, 16.4% identified as African American (n=10), and a small number of participants identified as either American Indian or other (3.2%, n=2). The mean age of participants was 53.49 (SD=12.82) years. The majority of participants were married (60.7%, n=37) and had completed middle school, high school, or secondary school (42.6%, n=26). Participants varied in how long they had been diagnosed with Type 2 diabetes. Regarding self-management practices, 11.5% of participants used an insulin pump (n=7). Most participants had been under the care of the nurse practitioner at this specialty practice for less than 1 year (73.2%, n=41).

An independent samples t-test was conducted to assess mean differences in health literacy between English and Spanish-speaking participants (see Table 4). Levene's test indicates homogeneity of variance for health literacy ($F=3.86$, $p=0.054$). There was a moderately significant mean difference in overall health literacy between English ($M=12.55$, $SD=2.15$) and Spanish-speaking participants ($M=11.32$, $SD=3.24$); $t(59)=1.76$, $p=.084$, $d=(0.455)$.

When the subscales of overall health literacy were examined individually, 23% of participants reported lack of confidence in their ability to fill out medical forms by themselves (n=14); 41% reported difficulty with learning about their diabetes because of difficulty understanding written information (n=25); and 23% reported needing assistance to read health materials (n=14). Significantly more Spanish-speaking participants reported difficulty learning about their diabetes because of difficulty understanding written information ($\chi^2(1) = 5.59^+$; $p=0.018$).

Process.

Table 2 presents process factors; including diabetes knowledge, diabetes self-efficacy, illness perception, and social support. Diabetes knowledge, self-efficacy, and illness perception yielded mean scores of: 15.71 (SD= 4.33), 149.86 (SD=31.04), and 39.25 (SD=11.11), respectively. Regarding social support, 85.2% of participants reported independence in self-management behaviors such as medication taking and blood sugar testing (n=52).

An independent samples t-test was conducted to assess mean differences in diabetes knowledge, self-efficacy, and illness perception between English and Spanish-speaking participants (see Table 4). Levene's test indicates homogeneity of variance for diabetes knowledge (F=0.001, p=0.98), self-efficacy (F= 2.30, p=0.14), and illness perception (F=2.14, p=0.15). There was a significant difference in diabetes knowledge between English (M=17.70, SD=3.85) and Spanish-speaking participants (M=13.19, SD=3.57); t(57)=4.61, p=<0.001, d=(1.209). There was a significant difference in illness perception between English (M=41.7, SD=8.94) and Spanish-speaking participants (M=35.88, SD=12.99); t(55)=2.01, p=0.05, d=(0.538).

Outcome.

Self-management behaviors served as the outcome factor in this scholarly project (see Table 2). Self-management was measured as a whole, and then the subconcepts of diet, exercise, blood sugar, foot care, and medication adherence were tested individually to calculate sub-scores. The mean score for overall self-management was 49.09 (SD=14.07). Diet, exercise, blood sugar, foot care, and medication adherence means were 20.65 (SD=6.54), 6.61 (SD=4.38), 10.42 (SD=4.26), 5.04 (SD=2.56), 6.37 (SD=1.74), respectively.

An independent samples t-test was conducted to assess mean differences in self-management behaviors between English and Spanish-speaking participants (see Table 4). In addition, self-management behaviors were divided into diet, exercise, blood sugar, foot care, and medication adherence sub-scores to assess for mean differences between English and Spanish-speaking participants. Levene's test indicates homogeneity of variance for overall self-management (F=1.33, p=0.25), as well as for diet (F=.88, p=0.35), exercise (F=0.04, p=0.85), and blood sugar subscores (F=2.55, p=0.12). Levene's test indicates heterogeneity of variance for foot care (F=6.39, *p*=0.01) and medication adherence subscores (F=5.65, *p*=0.02).There was a moderately significant difference in diet self-management behaviors between English (M=19.24, SD=5.81) and Spanish-speaking participants (M=22.58, SD=7.10); t (55)=-1.95, *p*=.056, d=(-0.523). In addition, there was a moderately significant difference in foot care self-management behaviors between Spanish-speaking (M=5.71, SD=2.10) and English-speaking participants (M=4.55, SD=2.79); t(55)=-1.80, *p*=0.08, d=(-0.459).

Factors Influencing Self-Management Behaviors

Table 3 details factors influencing self-management behaviors in the study sample. A linear regression model was constructed and executed to assess the impact of health literacy, diabetes knowledge, self-efficacy, and illness perception on self-management behaviors. Stepwise independent variable entry was used to obtain the best model fit. Results indicate a significant relationship (F(2, 50)=13.40, , *p*<0.001) with an R squared of 0.349. Illness perception (β=-.415, *p*=0.001) and self-efficacy (β=.307, *p*=0.014) were significant predictors of diabetes self-management behaviors. All VIF statistics were below 2.

Discussion

Context

The Individual and Family Self-Management Theory outlined by Ryan and Sawin (2009) posits that context affects both process factors and the outcome of self-management behaviors. The primary purpose of this scholarly project was to measure the impact of health literacy, diabetes knowledge, self-efficacy and illness perception on diabetes self-management behaviors. In this scholarly project, health literacy, a contextual factor, was not found to be a significant predictor of self-management behaviors. This aligns with findings from Bains & Egede (2011), Hahn et al. (2015) and Montoya (2015), who noted no direct association between health literacy and self-management behaviors. Though, Baines & Egede (2011) and McCleary-Jones (2011) discovered that health literacy indirectly influenced self-management behaviors via diabetes knowledge.

Although health literacy was not considered a significant predictor of diabetes self-management behaviors, it is notable that significantly more Spanish-speaking participants reported difficulty learning about their diabetes because of difficulty understanding written information. This finding is important to consider in the context of the scholarly project population's education level. Two-thirds of the Spanish-speaking population had achieved less than or equal to a high school education. This is critical to consider, as the literature shows that adults with less than a high school education are likely to have a below basic or basic level of health literacy (U.S. Department of Health & Human Services: Office of Disease Prevention and Health Promotion, 2008).

In addition, the data showed a moderately significant difference between English and Spanish-speaking participants' overall health literacy scores, with English-speaking participants having greater health literacy. This finding is consistent with that of Brice et al. (2008) and Hahn et al. (2015), who noted that Spanish-speakers had lower health literacy than English-speakers.

Process

Diabetes self-efficacy and illness perception were significant predictors of diabetes self-management behaviors. Diabetes self-efficacy was predictive of self-management behaviors, whereby participants who were more confident in their ability to manage their diabetes were more likely to perform more self-management behaviors. These findings align with Gao et al. (2013) and McCleary-Jones (2011), who revealed that self-efficacy directly influences diabetes self-management behaviors. This notion is additionally supported by Al-Khawaldeh et al. (2012), Bohanny et al. (2013), and Sharoni & Wu (2012), who noted that patients with greater self-efficacy reported a greater number of self-management behaviors.

Illness perception was a negative predictor of self-management behaviors, meaning that patients who perceived their illness to be more severe were more likely to partake in fewer diabetes self-management behaviors. This is consistent with the findings of Kugbey et al. (2017), who noted that illness perception was a significant negative predictor of diabetes self-management behaviors. Likewise, Abubakari et al. (2011) noted a significant negative association between illness perception and self-management behaviors, indicating that those who perceived their illness to be more severe had poorer self-management behaviors. Kugbey et al. (2017) postulated that when patients believe their illness is very severe, they may embrace a fatalistic perspective and therefore place little value on their personal role in self-management. Interestingly, in this scholarly project, English-speakers perceived their illness to be significantly more severe than did Spanish-speakers. An extensive review of the literature provided no evidence for why this may be; therefore, the project leader suggests further research be conducted in this area.

In this scholarly project, diabetes knowledge was not a significant predictor of diabetes self-management behaviors. This is consistent with findings from Abubakari et al. (2011) and Kurnia, Amatayakul, & Karuncharernpanit (2017), who noted that knowledge of diabetes does not permeate self-management behaviors. Conversely, Kueh et al. (2015) noted that diabetes knowledge was a significant predictor of whether patients performed blood glucose testing. In the same vein, Kugbey et al. (2017) and McCleary-Jones (2011) noted that diabetes knowledge predicted diet self-management behaviors. It is evident that the literature on diabetes knowledge and its impact on self-management behaviors is mixed. Kelly & Barker (2016) point out that knowledge does not necessarily translate to behavior change. However, the project leader posits that patients who have both disease-specific knowledge and providers that partner with them, schedule repeated follow-up visits to encourage success or problem solve issues, or show genuine concern for their knowledge or abilities, may be able to receive and translate diabetes knowledge into effective behavior change (Greene, Hibbard, Alvarez, & Overton, 2016). In this scholarly project, Spanish-speaking patients had significantly lower diabetes knowledge than their English-speaking counterparts, which is consistent with findings from Hahn et al. (2015).

Outcomes

In this scholarly project, Spanish-speaking participants had moderately significantly better diet and foot care self-management behaviors than their English-speaking counterparts. This may be explained by the patient-provider relationship, as the nurse practitioner at this clinic has language-concordance with her Spanish-speaking patients. Previous research has shown that patients who receive language-concordant care receive more counseling on diet and physical activity (Eamranond, David, Phillips, & Wee, 2009), have greater participation in self-management behaviors (Detz et al., 2014), and have improved glycemic control (Fernandez et al. 2011; Parker et al. 2017). Language-concordant care, combined with culturally-tailored patient education, may be useful for improving diabetes self-management behaviors in this population (Peek et al., 2012).

Ryan and Sawin (2009) posit that context affects both process and outcomes, while process simply affects outcomes. This scholarly project found that health literacy, a contextual factor, did not directly predict the outcome of diabetes self-management behaviors. The impact of contextual factors on process measures was not assessed within this scholarly project. However, further research related to how condition-specific, physical and social environment, and individual and family contextual factors influence process and outcomes is warranted based on the constructs of this theory. This scholarly project did find that diabetes self-efficacy and illness perception, two process factors, significantly predicted the outcome of diabetes self-management behaviors. These findings aligned with the theoretical notion that process measures directly affect outcomes. This scholarly project only viewed the proximal outcome of diabetes self-management behaviors. However, further research which views how contextual and process factors influence both proximal and distal outcomes would certainly add to the body of literature on diabetes self-management.

Implications for Practice

The findings from this scholarly project reveal that interventions that target patients' self-efficacy and illness perception have the greatest likelihood of improving diabetes self-management behaviors. Considering that adult patients with Type 2 diabetes may only spend 20 minutes quarterly with their diabetes care provider, interventions to improve self-management must be patient-centered. Diabetes mobile health interventions may offer a practical and effective approach to improving diabetes care between office visits in a time-constrained healthcare environment (Arambepola et al., 2016). Mobile phone-based diabetes interventions demonstrate a wide reach with low cost (Arambepola et al., 2016). Moreover, they have demonstrated effectiveness in decreasing HgA1C (Arambepola et al., 2016; Goodarzi, Ebrahimzadeh, Rabi, Saedipoor, & Jafarabadi, 2012); increasing medication adherence (Arora, Peters, Burner, Lam, & Menchine 2014; Nelson, Mulvaney, Gebretsadik, Johnson, & Osborn, 2016); decreasing emergency department utilization (Arora et al., 2014); and increasing self-efficacy (Arora, Peters, Agy, & Menchine, 2012; Goodarzi et al., 2012). In addition, patients have found text-based interventions to be both helpful and relatively easy to use (Dick et al.

2011). The scholarly project leader agrees with recommendations for mobile-phone based interventions which are presented at an appropriate literacy level, contain clinically relevant information, and are presented in a way that promotes behavior change (Abebe et al. 2013). Based on findings from this scholarly project, which showed that 41% of participants struggled with written information, the project leader suggests that text-based interventions have an audio component, allowing patients to hear instead of read messages to improve self-management behaviors.

To date, little research has assessed the impact of mobile-phone based interventions on improving illness perception. Petrie, Perry, Broadbent, & Weinman (2012) tested an illness and treatment perception intervention in a population of 16 to 45-year old patients with asthma and found that those who received text messages had increased perceived need for their preventative medication, perception of the longevity of their disease, and perception of control over their disease. In addition, the intervention group had improved medication adherence (Petrie et al., 2012). Interventions such as these are promising. However, until further research is conducted in this area, providers should work to spend a small portion of each diabetes care visit providing patients with appropriate diabetes education, including specific information on: diabetes causes, consequences, timeline, personal control, treatment control, and symptoms. Reframing patients' perceptions of their diabetes may help to empower them and assist them to move towards improved self-management behaviors.

Limitations and Strengths

There are three major strengths of this scholarly project. First, valid and reliable tools were used for data collection, which enhanced statistical conclusion validity. Second, this scholarly project assessed several factors that may influence diabetes self-management behaviors, in an effort to gain a comprehensive overview of how to improve diabetes care and patient education. Third, this scholarly project compared differences between English and Spanish-speaking patients, adding to the body of literature on linguistic differences that may contribute to existing disparities in diabetes health outcomes. Although this scholarly project was strong in its design, there are notable limitations. First, this scholarly project was conducted in only one clinic, which possessed a language-concordant provider who spends at least 30 minutes to one hour with her patients. With this, findings may not be generalizable to all patients with Type 2 diabetes. Second, data was self-reported and thus may have led to some recall or social desirability bias, as data was collected in a small private practice where patients have a close, personal relationship with their language-concordant provider. This type of care is not representative of most Spanish-speaking patients in the U.S., who are likely receiving care across language barriers which are known to impact quality of care (Fernandez et al., 2011). Future studies could benefit from a larger, randomized sample in more than one clinical setting. In addition, a comparison of self-management behaviors in patients who benefit from language-concordant care and those who do not would provide meaningful information as well.

Conclusion

This scholarly project assessed contextual and process factors associated with diabetes self-management behaviors in English and Spanish-speaking adults with Type 2 diabetes. Health literacy, a contextual factor, did not significantly predict diabetes self-management behaviors in this sample. However, diabetes self-efficacy and illness perception, two process factors, were found to significantly predict diabetes self-management behaviors. These findings contribute to a better understanding of where to focus self-management intervention efforts in a time-constrained healthcare environment. Linguistic comparison revealed that English-speaking participants possessed significantly greater diabetes knowledge and perceived their illness to be more severe. In addition, English-speaking participants had moderately significantly greater health literacy, while Spanish-speaking participants had moderately significantly greater diet and foot care self-management behaviors.

Future research should focus on evaluating community-based diabetes self-efficacy and illness perception interventions, in an effort to improve self-management practices and therefore glycemic control. In addition, qualitative research which assesses why there are linguistic differences in health literacy, illness perception, diabetes knowledge, and diabetes self-management behaviors would be useful based on findings from this scholarly project.

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Tables

Table 1: Contextual Factors

Demographics	Sample	English	Spanish	Sig.
n	61(100%)	33(54.1%)	28(45.9%)	
Age	53.49(SD=12.82)			F (1,57) = 2.20; *p*=0.143
Gender (%)				$\chi^2(1) = 0.082$; *p*=0.775
Male	26(42.6%)	14(42.4%)	12(46.2%)	
Female	33(54.1%)	19(57.6%)	14(53.8%)	
Ethnicity				$\chi^2(4) = 50.13^+$; *p*<0.001
White	19(31.1%)	19(57.6%)	0(0%)	
American Indian	1(1.6%)	0(0%)	1(3.6%)	
Latino/Hispanic	30(49.2%)	3(9.1%)	27(96.4%)	
African American	10(16.4%)	10(30.3%)	0(0%)	
Other	1(1.6%)	1(3.0%)	0(0%)	
Survey Version				
English	33(54.1%)			
Spanish	28(45.9%)			
Marital Status				$\chi^2(5) = 6.45^+$; *p*=0.265
Single	7(11.5%)	6(18.2%)	1(3.6%)	
Married	37(60.7%)	17(51.5%)	20(71.4%)	
Widowed	4(6.6%)	2(6.1%)	2(7.1%)	
Divorced	8(13.1%)	6(18.2%)	2(7.1%)	
Separated	1(1.6%)	0(0%)	1(3.6%)	
Living with someone	4(6.6%)	2(6.1%)	2(7.1%)	
Education				$\chi^2(3) = 18.40^+$; *p*=<0.001
Elementary/Primary	10(16.4%)	0(0%)	10(37%)	
Mid/High/Secondary	26(42.6%)	18(54.5%)	8(29.6%)	
Vocational/Technical	10(16.4%)	4(12.1%)	6(22.2%)	
College/University	14(23.0%)	11(33.3%)	3(11.1%)	
Length of Type 2 Diagnosis				$\chi^2(4) = 6.67^+$; *p*=0.155
Less than 1 year	3(4.9%)	1(3.0%)	2(7.4%)	

1-5 years	13(21.3%)	5(15.2%)	8(29.6%)	
6-10 years	12(19.7%)	5(15.2%)	7(25.9%)	
11-15 years	14(23.0%)	8(24.2%)	6(22.2%)	
16 or more years	18(29.5%)	14(42.4%)	4(14.8%)	
Length of Time in Care				$\chi^2(4) = 4.80^+$; p=0.309
1 day-1 month	8(13.1%)	3(9.7%)	5(20.0%)	
2-4 months	9(14.8%)	5(16.1%)	4(16.0%)	
4-6 months	10(16.4%)	7(22.6%)	3(12.0%)	
6 months-1 year	14(23.0%)	10(32.3%)	4(16.0%)	
1-2 years	15(24.6%)	6(19.4%)	9(36.0%)	
Insulin Pump				$\chi^2(1) = 0.625^‡$ p=0.429
Yes	7(11.5%)	5(16.7%)	2(9.1%)	
No	45(73.8%)	25(83.3%)	20(90.9%)	
Health Literacy Q1				$\chi^2(1) = 0.068^+$; p=0.795
Inadequate	14(23.0%)	8(24.2%)	6(21.4%)	
Adequate	47(77.0%)	35(75.8%)	22(78.6%)	
Health Literacy Q2				$\chi^2(1) = 5.59^+$; p=0.018
Inadequate	25(41.0%)	9(27.3%)	16(57.1%)	
Adequate	36(59.0%)	24(72.7%)	12(42.9%)	
Health Literacy Q3				$\chi^2(1) = 0.123^+$; p=0.726
Inadequate	14(23.0%)	7(21.2%)	7(25.0%)	
Adequate	47(77.0%)	26(78.8%)	21(75.0%)	
$^+$ Exact significance(2 tailed); ‡ Fishers Exact				

Table 2: Process and Outcome Factors

	Sample	English	Spanish	Sig.
Social Support				$\chi^2(1) = 0.72^+$; p=0.788
Independent Management	n=52(85.2%)	29(87.9%)	23(82.1%)	
Assistance	n=6(9.8%)	3(9.1%)	3(10.7%)	
Diabetes Knowledge	$\bar{x}$=15.71 (SD=4.33); n=59			
Diabetes Self-Efficacy	$\bar{x}$=149.86 (SD=31.04); n=53			
Illness Perception	$\bar{x}$=39.25 (SD=11.11); n=57			
Self-Management	$\bar{x}$=49.09 (SD=14.07); n=57			
Diet Subscore	$\bar{x}$=20.65 (SD=6.54); n=57			
Exercise Subscore	$\bar{x}$=6.61 (SD=4.38); n=57			
Blood Sugar Subscore	$\bar{x}$=10.42 (SD=4.26); n=57			
Foot Care Subscore	$\bar{x}$=5.04 (SD=2.56); n=57			
Medication Adherence Subscore	$\bar{x}$=6.37 (SD=1.74); n=57			

Table 3: Factors Influencing Self-Management Behaviors

	β	t	*p*	F	P	95% CI
Constant		4.35	<0.001	13.40	<0.001	
Illness Perception	-0.415	-3.435	0.001			-0.792, -0.208
Self-Efficacy	0.307	2.540	0.014			0.028, 0.239

Table 4: Independent Samples T-Test

	Diff		English			Spanish						
	M	SE	M	SD	n	M	SD	n	t	df	p	95% CI
Health Literacy	1.22	0.70	12.55	2.15	33	11.32	3.24	28	1.76	59	0.084	-0.17, 2.62
Diabetes Knowledge	4.51	0.98	17.70	3.85	33	13.19	3.57	26	4.61	57	p<0.001	2.55, 6.46
Self-Efficacy	-2.37	3.79	152.23	26.61	33	145.95	37.66	20	0.710	51	0.481	-11.47, 24.02
Illness Perception	5.82	2.90	41.70	8.94	33	35.88	12.99	24	2.01	55	0.050	0.004, 11.64
Self-Management	-2.37	3.79	48.09	11.72	33	50.46	16.95	24	-0.624	55	0.535	-9.97, 5.24
Diet Self-Management	-3.34	1.71	19.24	5.81	33	22.58	7.10	24	0.351	55	0.056	-0.677, 0.090
Exercise Self-Management	0.77	1.18	6.94	4.39	33	6.17	4.42	24	0.655	55	0.516	-1.593, 3.139
Blood Sugar Self-Management	0.87	1.15	10.79	3.79	33	9.92	4.88	24	0.759	55	.451	-1.43, 3.172
Foot Care Self-Management	-1.16	0.65	4.55	2.79	33	5.71	2.10	24	-1.79	54.92	.078	-2.46, 0.133
Medication Adherence Self-Management	0.49	0.52	6.58	1.09	33	6.08	2.36	24	0.952	30.19	0.349	-.564, 1.549